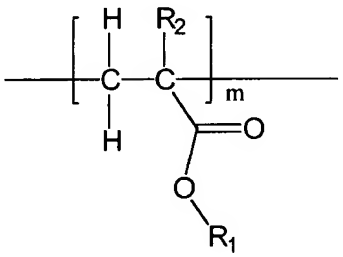
LISTING OF CLAIMS

1. (Previously Presented) A method of forming an underlayer of a bi-layer resist film, comprising:

forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, and m is an integer ranging from 10 to 500;

coating a substrate with the blended material; and

irradiating the blended material coated on the substrate.

2. (Original) The method according to claim 1, wherein the polymer having an aromatic group is a novolac polymer or a naphthalene polymer.

3. (Original) The method according to claim 2, wherein the methacrylate polymer is blended to 20 to 70 wt% of a sum of weights of the novolac and the methacrylate polymers.

4. (Original) The method according to claim 2, wherein the methacrylate polymer is blended to 20 to 70 wt% of a sum of weights of the naphthalene and the methacrylate polymers.

5. (Original) The method according to claim 1, wherein the blended material futher includes:

at least one selected from a group consisting of a thermal acid generator, a cross-linker and a surfactant.

6. (Original) The method according to claims 1, wherein the coated substrate is irradiated with UV rays or an e-beam.

7. (Original) The method according to claim 6, wherein the UV rays have a wavelength of about 150 nm to about 180 nm.

8. (Original) The method according to claim 7, wherein the UV rays have a wavelength of about 172 nm.

9. (Original) The method according to claim 6, wherein the UV rays have energy of about 0.1 J/cm^2 to about 100 J/cm^2.

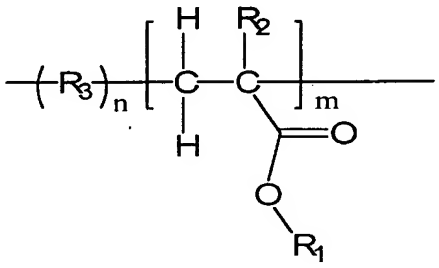
10. (Original) The method according to claim 6, wherein the e-beam has energy of about 0.1 mC/cm^2 to about 100 mC/cm^2.

11. (Original) The method according to claims 1, wherein the coated substrate is irradiated at a temperature of about room temperature to about 100 °C.

12. (Original) The method according to claim 11, wherein the temperature at which the coated substrate is irradiated is adjusted using a hot plate or a halogen lamp.

13. (Previously Presented) A method of forming a underlayer of a bi-layer resist film, comprising:

preparing a material including a copolymer having a monomer with an aromatic group and a methacrylate monomer, the copolymer represented by the following chemical formula:

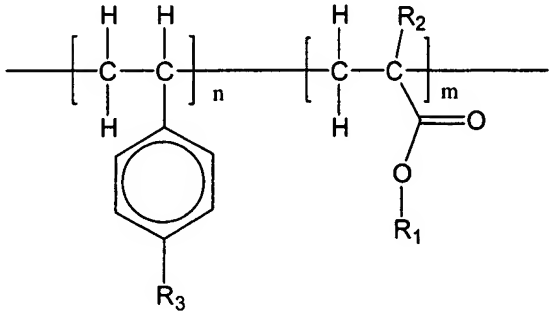


wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, R_3 is a monomer having an aromatic group, and each of m and n is an integer ranging from 10 to 500;

coating a substrate with the prepared material; and

irradiating the prepared material coated on the substrate.

14. (Previously Presented) The method according to claim 13, wherein the copolymer is a copolymer having styrene and methacrylate monomers, the copolymer represented by the following chemical formula:



wherein, R1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R2

is a hydrogen or a methyl group, R_3 is one selected from a group consisting of hydrogen, a hydroxyl group, a chlorine and a bromine, and each of m and n is an integer ranging from 10 to 500.

15. (Original) The method according to claim 14, wherein the mole ratio m/(m + n) is about 0.3 to about 0.6.

16. (Original) The method according to claim 13, wherein the material including the copolymer further includes:

at least one selected from a group consisting of a thermal acid generator, a cross-linker and a surfactant.

17. (Original) The method according to one of claims 13, wherein the coated substrate is irradiated with UV rays or an e-beam.

18. (Original) The method according to claim 17, wherein the UV rays have a wavelength of about 150 nm to about 180 nm.

19. (Original) The method according to claim 18, wherein the UV rays have a wavelength of about 172 nm.

20. (Original) The method according to claim 17, wherein the UV rays have energy of about 0.1 J/cm^2 to about 100 J/cm^2.

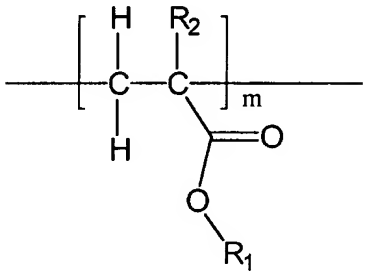
21. (Original) The method according to claim 17, wherein the e-beam has energy of about 0.1 mC/cm^2 to about 100 mC/cm^2.

22. (Original) The method according to claim 13, wherein the irradiation of coated substrate is performed at a temperature of about room temp. to about 100 °C.

23. (Original) The method according to claim 22, wherein the temperature at which the coated substrate is irradiated is adjusted using a hot plate or a halogen lamp.

24. (Previously Presented) A method of forming a semiconductor device using a bi-layer resist, comprising:

forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, and m is an integer ranging from 10 to 500;

coating a substrate with the blended material;

forming an underlayer by irradiating the blended material coated on the substrate;

forming a toplayer over the underlayer;

forming a toplayer pattern in the toplayer;

forming an underlayer pattern by etching the underlayer using the toplayer pattern as an etch mask; and

etching the substrate using the underlayer pattern as an etch mask.

25. (Original) The method of claim 24, further comprising:

performing a first prebake after coating the substrate with the blended material.

26. (Original) The method of claim 25, further comprising:

performing a second prebake after forming a toplayer over the underlayer.

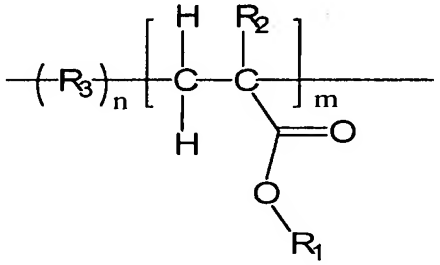
27. (Original) The method of claim 24, further comprising:

removing the toplayer and the underlayer after etching the substrate.

28. (Original) The method of claim 27, wherein the toplayer and the underlayer are removed by ashing.

29. (Previously Presented) A method of forming a semiconductor device using a bi-layer resist, comprising:

preparing a material including a copolymer having a monomer with an aromatic group and a methacrylate monomer, the copolymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, R_3 is a monomer having an aromatic group, and each of m and n is an integer ranging from 10 to 500;

coating a substrate with the prepared material;

forming an underlayer by irradiating the prepared material coated on the substrate;

forming a toplayer over the underlayer;

forming a toplayer pattern in the toplayer;

forming an underlayer pattern by etching the underlayer using the toplayer pattern as an etch mask; and

etching the substrate using the underlayer pattern as an etch mask.

30. (Original) The method of claim 29, further comprising:

performing a first prebake after coating the substrate with the prepared material.

31. (Original) The method of claim 30, further comprising:

performing a second prebake after forming a toplayer over the underlayer.

32. (Original) The method of claim 29, further comprising:

removing the toplayer and the underlayer after etching the substrate.

33. (Original) The method of claim 32, wherein the toplayer and the underlayer are removed by ashing.